

# Lead intoxication of suckling infants in three cases of maternal exposure

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## ABSTRACT

*This paper reports three cases of occupational intoxication by lead in women who were breast-feeding. Their infants showed symptoms of intoxication despite the low lead blood levels between 5.5 and 8.0 mg/dl. Intoxication was evaluated by quantifying the amount of lead in maternal milk, as well as in the mothers and infants' blood before and after treatment. After chelation with CaNa<sub>2</sub>-EDTA and supportive treatment, we observed a decrease of lead levels, disappearance of symptoms, and marked improvement in the infants' general condition.*

**Keywords:** lead, occupational exposure, EDTA, suckling infants.

## INTRODUCTION

Lead intoxication is one of the most relevant environmental diseases due to the high levels of lead in the environment and to the occupational contamination following chronic exposure.

Chronic lead intoxication, as a result of environmental and occupational exposure, occurs mainly in areas highly industrialized leading to hematological, endocrine, gastrointestinal and neurological problems (Hammond & Dietrich, 1990; Lockitch, 1993).

Presently, it is recognized that the susceptibility of children to lead intoxication, through maternal exposure, may cause risk to future generations. Recently, it was demonstrated that neurobehavioral sequel, due to maternal intoxication, may be observed in the second generation of their sons (Trombini et al., 2001).

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The concept of significance of the stage of development of the individual and the period of exposure has become quite important in the evaluation of the toxicological risk. Just as an example, children are known to absorb a greater percentage of lead in the gastrointestinal tract than adults (Graeter & Mortensen, 1996).

Lead is excreted in both animal and human milk (Sternovsk & Wesolowski, 1985; Schramel et al., 1988) although the limitation imposed by the placenta due to the maternal and fetal concentration gradient (Mc Claims & Becker, 1975). Studies conducted in humans and experiments in animals have documented that inorganic lead cross the placenta barrier and thus concentrating in the fetal tissues (Goyer, 1990; Dietrich, 1991; Klein et al., 1994).

The present study reports three cases of lead intoxication in children of breast-feeding mothers occurred between 1997 and 1999. Mothers and their children were assisted, treated and the cases were documented in the Center for Toxicological Information (CEATOX) of the Institute of Biosciences, UNESP-Botucatu, São Paulo, Brazil.

## CASE REPORT

Case 1 – S.T.S., 25 years old, a hair stylist for 9 years, and breast-feeding her 4 months-old baby. The mother showed insomnia, restlessness, abdominal pain, muscular weakness and pain, intense hair loss and a poor defined immunity deficiency. Her baby present with diarrhea, loss of weight and restlessness.

Case 2 – R. A. F. T., 30 years old, a hair stylist for 11 years and breast-feeding her 6 months –old baby. The mother showed insomnia, headache, muscular weaknesses and pain and abdominal colic. Her baby showed diarrhea, occasionally bloody, weight loss and restlessness.

Case 3 – E. B., 26 years old, nursing assistant in the UNESP hospital for 15 years and breast-feeding her 8 months old baby. The mother showed acute lead intoxication after explosion of the batteries of a surgical light in the surgical theater where she used to work. She and other people working in the same place referred that they felt a strong odor like rotten egg, most probably due to the liberation of lead sulfate and showed dizziness. The next days they present, in various forms, nausea, hypertension, pain in the joints and in the neck, muscular weakness, patch all over the body, lip tingling, blurred vision, lip and nasal bleeding and abdominal pain. These cases were seen in the CEATOX three days after the accident and lead intoxication was diagnosed. In the same period, the baby of E.B. presented lack of appetite, diarrhea and restlessness.

In the three cases reported in this study it was obtained the consented agreement for publication of clinical data.

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## BLOOD SAMPLING AND LEAD ANALYSES

Blood samples were collected in vacuum tubes with heparin, refrigerated, but not frizzed, and send to the lab for analyses. Lead analyses were conducted with an atomic absorption spectrophotometer Hitachi, model Z-5700, with a graphite atomizer oven (Yeager, et al., 1971). This is a valid and widely used technique to the determination in biological materials of heavy metals such as lead, due to the high sensitivity (detection close to  $10^{-5}$ mg/dl and quantification close to  $10^{-4}$ mg/dl), selectivity and because the technique requires a small sample amount.

### Treatment protocol

#### I - Mothers:

Restrain from work;

Lead chelant treatment: with 2 capsules of  $\text{CaNa}_2\text{-EDTA}$  (250mg) each 6 hours, for 10 days, repeating treatment after an interval of 7 days.

Supportive treatment: Benerva (300mg), Metilcolin B12 (250mg), Memoriol B6 (200mg), Ephynal 400 (400mg), twice a day for 60 days.

#### II - Infants:

Discontinued breast-feeding;

Lead chelation treatment: 25mg de  $\text{CaNa}_2\text{-EDTA}$ /day mixed to milk for ten days, repeating treatment after an interval of 7 days.

## RESULTS

TABLE I shows results for quantification of lead before and after treatment. It is possible to observe the levels of lead confirming the intoxication and the efficacy of the treatment.

TABEL I - Comparison of lead levels (mg/dl) in blood and maternal milk and in blood samples of the evaluated children.

Case	Sample type	Lead concentration (mg/dl)	
		Before treatment	After treatment
S.T.S	Maternal milk	26.0	0.8
	Maternal blood	15.3	2.3
	Infant blood	8.0	ND
R.A.F.T.	Maternal milk	15.2	1.0
	Maternal blood	12.9	1.8
	Infant blood	7.8	ND
E.B.	Maternal milk	40.0	1.2
	Maternal blood	27.0	2.5
	Infant blood	5.5	ND

ND = non detected

## DISCUSSION

Lead intoxication in early childhood should be prevented since it can cause important modification in the neonatal development and serious effects in many organs (Graeter & Mortensen, 1996).

The present study reports three cases of babies with acute lead intoxication, revealing the need and importance for quick diagnose and oportune treatment.

Some studies reveal that cognitive deficiencies may result from lead exposure during the first 5 years of life (Pocock et al., 1994). Serum lead levels of 10mg/dl, according to reports in the international literature, may lead to sudden death in children, while other reports mention that these high levels do not cause symptoms of intoxication. These reports induced some proposals advocating the need for routine lead measurement in all risk groups, including children between ages 6 months and 6 years (Hammond & Dietrich, 1990). This proposal was strongly criticized by Harvey (1994).

Children in this study, although showing a low blood level of lead, presented symptoms. Probably, these intoxications occurred only because were closely associate to the type of occupation of the mother, in cases S. T. S. and R. A. F., in their respective occupational environment, and in the case E. B., due to the accident.

It is interesting that, in these three cases, the levels of lead in the mothers were higher in the milk than in the blood. If ingested lead is absorbed by the GI tract in children (Graeter & Mortensen, 1996), and if lead may be transposed through the maternal blood to the fetus (Klein et al., 1994), it is reasonable that the lead found in the children could come both from the maternal milk and the mother blood during pregnancy.

Chelation with  $\text{CaNa}_2\text{-EDTA}$  is a classical treatment used in lead intoxication, although it has been associated to encephalopatias in some cases. In children it can lead to a rapid modification in the mental status with apprehension and brain edema. However, risk for this encefalophaty was attributed to the high level of lead detected in the patients (Chilsom, 1968; Cory-Slechta, 1987).

Recently, experimental studies have confirmed the chelant properties of  $\text{CaNa}_2\text{-EDTA}$  and its indication in the treatment of occupational lead intoxication and, mainly, during pregnancy (Jones Et Al., 1994; O' Hara et Al., 1995; Soldatovic et al., 1997).

The common practice of complement chelation with administration of hepatic stimulants and vitamins has been the choice treatment due to the effectiveness while treating cases at CEATOX. Indeed, this additional treatment has proved to be efficient, associated to chelation, leading to a reduction in the level of lead in intoxicated children and mothers, determining a marked improvement in the general condition of patients and disappearance of symptoms.

In cases of lead intoxication in children it is important to conduct a complete analysis of the domestic and working environment in order to identify and eliminate possible sources. In these cases its is also impor-

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tant to include some potential sources of exposition such as drinking water and contact with china, cosmetics, furniture and colored toys containing inorganic lead pigments.

## CONCLUSIONS

Data from this study allow the following conclusions:

- Lead was transferred to children through maternal milk, in low concentration, although enough to produce intoxication.
- The treatment protocol used was effective since it reduced the levels of lead, both in children and in mothers, leading to disappearance of symptoms.
- Quantification of lead in maternal milk may be used as an index to evaluate the intoxication since it is a non-invasive method.
- Educational and preventive programs are necessary to call attention to occupational risk for lead intoxication, mainly among pregnant women.

## BIBLIOGRAPHIC REFERENCES

- 1 CHISOLM J. J. The use of chelating agents in the treatment of acute and chronic lead intoxication in childhood. *J. Pediatr.*, v.73, p.1-38, 1968.
- 2 CORY-SLECHTA D. A. , WEISS B., COX C. Mobilization and redistribution of lead over the course of calcium disodium ethylenediamine tetraacetate chelation therapy. *J. Pharmacol. Exp. Ther.*, v.243, p.804-813, 1987.
- 3 DIETRICH K. N.: Human fetal lead exposure: intrauterine growth, maturation, and postnatal neurobehavioral development. *Fundam. Appl. Toxicol.*, v.16, p.17-19,1991.
- 4 GOYER R. A. Transplacental transport of lead. *Environ. Health Perspect.*, v. 9, p.101-105, 1990.
- 5 GRAETER L. J.; MORTENSEN M. E. Kids are different: developmental variability in toxicology. *Toxicology*, v.111, p.15-20, 1996.
- 6 HAMMOND P.B.; DIETRICH K. N. Lead exposure in early life: Health consequences. *Reviews of environmental contamination and toxicology*. New York, v.115, p.91-124, 1990.
- 7 HARVEY B. Should blood lead screening recommendations be revised? *Pediatrics*, v.93, p. 201-204,1994.
- 8 JONES M. M.; BASINGER M.A.; GALE G. R.; ATKINS L. M.; SMITH A. B.;STONE A. Effect of chelate treatments on kidney,

- bone and brain lead levels of lead intoxicated mice. *Toxicology*, v.89, p. 91-100,1994.
- 9 KLEIN M.; KAMINSKY P.; BARBE F.;DUC M. Lead in pregnancy. *Presse Med*, v.24, p. 576-580, 1994.
  - 10 LOCKITCH G. Perspectives on lead toxicity. *Clin. Biochem.*, v.26, p.371-381, 1993.
  - 11 Mc CLAIN R. M., BECKER B. A. Teratogenecity, fetal toxicity, and placental transfer of lead nitrate in rats. *Appl. Pharmacol.*, v.31, p.72-82, 1975.
  - 12 O'HARA T. M.; BENNETT L.; MCCOY C. P.; JACK S. W.; FLEMING S. Lead poisoning and toxicokinetics in a heifer and fetus treated with  $\text{CaNa}_2\text{EDTA}$  and thiamine. *J. Vet. Diagn. Invest.*, v.7, p.531-537,1995.
  - 13 POCOCK S. J.; SMITH M.; BAGHURST P. Enviromental lead and children's intelligence: a systematic review of the epidemiological evidence. *Br. Med. J.*, v.309, p. 1189-1197,1994.
  - 14 SCHRAMEL P.; HASSE S.; OVCAR-PAVLU J. Selenium, cadmium, lead, and mercury concentration in human breast milk in placenta, maternal blood, and the blood of the newborn. *Biol. Trace Elem. Res.*, v.15, p.111-124, 1988.
  - 15 SOLDATOVIC D.; VUJANOVIC D.; MATOVIC V.; PLAMENAC Z. Compared effects of high oral Mg supplements and of EDTA chelating agent on chronic lead intoxication in rabbits. *Magnes. Res.*, v.10, p.127-133, 1997.
  - 16 STERNOVSKY, H. J.; WESSOLOWSKY R. Lead and cadmium in breast milk. Higher levels in urban vs rural mothers during the first 3 months of lactation. *Arch. Toxicol.*, v. 57, p. 41-45, 1985.
  - 17 TROMBINI T. V.; PEDROSO C. G.; PONCE D.; ALMEIDA A. A.; GODINHO A. F. Developmental lead exposure in rats: is a behavioral sequel extend at F2 generation ? *Pharmacol. and Biochem. and Behav.*, v.68, p.743-751, 2001.
  - 18 YEGER D. W.; CHOLAK J.; HENDERSON E. W. Determination of lead in biological and related material by atomic absorption spectrophotometry. *Environ. Sci. Technol.*, v.5, p.1020 -1022, 1971.

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